

## Test Program Overview

The Air Resources Board performed a study to compare the emissions from cleaner burning gasoline blended with ethanol to the emissions of cleaner burning gasoline blended with MTBE. The final test data became available May 27, 1998. The test fuels were formulated from the same hydrocarbon base stock to minimize variation. The fuel properties are shown in Table 1.

Twelve vehicles covering a range of model years 1990 through 1995 were tested for exhaust emissions using the federal test procedure and REP05 test procedure. Six of these vehicles also were tested for evaporative emissions using a modified enhanced evaporative test procedure. All test samples were speciated to allow evaluation of the emissions on a reactivity adjusted basis. Table 2 describes the vehicles tested.

### Test Fuels

Two gasoline blends were selected for testing. The MTBE and ethanol gasoline blends were created by blending 10 volume percent ethanol and 11 volume percent MTBE to the same hydrocarbon base stock, respectively. The key differences between the two fuels are the Reid vapor pressure and oxygen content. The ethanol blend contains about 3.5 weight percent oxygen and has a Reid vapor pressure (RVP) of 8 pounds per square inch (psi). The MTBE blend is fully complying with the requirements for California's cleaner burning gasoline.

**Table 1**  
**Target Properties of Test Fuels\***

Property	ETOH	MTBE
	Target	Target
Oxygen (wt%)	3.2 - 3.6	1.8 - 2.2
Aromatics (vol %)	23.0 - 25.0	23.0 - 25.0
Olefins (vol%)	4.0 - 6.0	4.0 - 6.0
Benzene (vol%)	0.5 - 1.0	0.5 - 1.0
RVP (psi)	7.6 - 8.0	7.6 - 8.0
T10 (deg F)	130 - 140	130 - 140
T50 (deg F)	190 - 210	190 - 210
T90 (deg F)	280 - 300	280 - 300
Sulfur (ppmw)	30 - 40	30 - 40

\* See Appendix E in the test report more details.

\*\* Only ARB analytical results were used to calculate the average. Where replicates samples were taken, the mean was used for the analysis.

## Description of Vehicles and Fuels Tested

**Table 2:**  
**Vehicle Descriptions**

Veh #	Model Year	Mfg	Model Tested	Engine Family	Evap Family	Emission Control Systems*	Testing Purpose
2	1993	Mazda	MPV	PTK3.0T5FCC5	-----	HO2S,TWC,MPI	exh only
3	1994	Toyota	Camry	RTY2.2VJG2GA	-----	O2S,TWC,MPI,EGR	exh only
4	1990	Honda	Integra	LHN1.8V5FXC7	-----	O2S,TWC,MPI,EGR	exh only
5	1992	GM	Cutlass	N1G3.1W8XGZ1	-----	O2S,TWC,MPI,EGR	exh only
6	1991	Ford	Explorer	MFM4.0T5FAM0	-----	HO2S,TWC,MPI	exh only
7	1993	Ford	Escort	PFM1.9V5FCC2	HM	HO2S,TWC,MPI,EGR	exh+ evp
8	1991	Chrysler	Caravan	MCR3.3T5FBRX	MCRTC	HO2S,TWC,MPI	exh+ evp
9	1995	GM	Grand AM	S1G3.1V8GFEA	S1G1058AYMOA	HO2S,TWC,MPI,EGR	exh+ evp
10	1994	Nissan	Sentra	RNS1.6VJG1EA	RNS1030BYMOA	O2S,TWC,MPI,EGR	exh+ evp
11	1990	Honda	Accord	LHN2.2V5FPC1	90 FG	HO2S,TWC,MPI,EGR	exh+ evp
13	1992	Toyota	Lexus	NTY4.0V5FBB6	EV-SE	HO2S,TWC,WUTWC, MPI,EGR	exh+ evp
14	1995	Nissan	Pathfinder	SNS3.028GEEA	-----	HO2S,TWC,WUTWC, MPI,EGR	exh only

\* Emission Controls

O2S = oxygen sensor

HO2S = heated oxygen sensor

TWC = three-way catalytic converter

WUTWC = warm-up TWC

EGR = exhaust gas recirculation

MPI = multipoint fuel injection

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